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SEED PRODUCTION OF SCALLOP

I. ARTIFICAIL SEED COLLECTION*

OGAWA, Hiroki YOKOYAMA, Masayuki SATO, Atsushi ITO, Susumu

FOREWORD

The Aomori Prefectural Aquaculture Center started its activities in 1968. p.110

Before the official opening of the center, we used the facilities of the unfinished center since March, 1968, and performed experimental spawning inducement and artificial seed collection of scallop. We present the outline here.

Before proceeding, we extend our appreciation to the staff of the Kawauchi Fisheries Co-op, which helped us to collect mother shells.

MATERIALS AND PROCEDURES

1. Mother Shells

The mother shells which were used for spawning inducement were 3 to 7-year-old shells, and the length of shell was 7.3 - 16.8 cm. They were collected at Moura, Tsuchiya, and Kawauchi in the Mutsu Bay from February 12 to April 3, 1968.

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* Details are announced in Aomori Suisan Zoshoku Senta Shiryo (Report of Acquaculture Center, Aomori Prefecture), S43-No.1 (June, 1968).

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2. Method of Spawning Inducement

We gathered mother shells in a fish box and induced the shells to spawn, running warm sea water of about 15°C into the box. Whenever we saw mother shells which started spawning, we picked them up and transferred them to a Pan-lite fish tank of 30 ℓ which was filled with filtered warm seawater of about 15°C and let them continue spawning. When the seawater in the tank became pale pink from the spawned eggs, we pulled out the mother shells from the tank.

Then we picked up male shells that were spermatizing in a fish box, and put them in the Pan-lite fish tank in which the eggs had been spawned, and let the males spermatize 2-3 times. After removing them from the tank, we performed insemination. We maintained the water temperature at 15°C by adjusting the room temperature and cleaned the eggs five times at intervals of one hour using filtered seawater of 15°C. Then, after the fertilized eggs developed and more than half of the larvae started swimming to the surface, we transferred only the swimming larvae to another fish tank and removed those remaining at the bottom.

3. Method of Rearing Free-swimming Larvae

When the larvae became D-type larvae after the beginning stage of development, we started rearing them in 3 polyethylene tanks of 500 ℓ each (No.1-3), putting 230,000-500,000 larvae in each tank, which was filled with filtered sea water of 17°C. These polyethylene tanks were placed in concrete tanks and heated from outside to maintain 17°C. We continued rearing in this way.

Rearing was performed by the still water method and we ventilated each tank lightly. Also we changed the whole water in the tanks every 2 days.

For feed, we used cultured Chaetoceros calcitrans (Ch) and Monochrysis lutherii (Mc). After cleaning them with a continuous centrifugal machine, we mixed them at the rate of Mc 1 : Ch 2 in number of cells. We fed the larvae twice a day, morning and evening. p.111

The amount of feed was 2,000 cells/larva (converted in Mc) up to 6 days after fertilization (average length of shell 143 μ), 3,000 cells/larva up to 12 days (average length 192 μ), 8,000 cells/larva after that.

Regarding the tank No. 2, the amount of feed was 5,000 cells/larva (Mc only) 14 days after fertilization when eye spots started emerging (average length 262 μ), 8,000 cells/larva (Mc only) 19 days after.

When the free-swimming larvae reached the attaching period, we put, as a collector, Hi-zex films in the tank No. 1, hemp-palm bark in No. 2, and polycarbonate film in No. 3.

4. Method of Rearing the Attached Spats

The method of rearing the attached spats was the same as the method of rearing free-swimming larvae, but we changed the water every 5 days. The amount of feed was still 8,000 cells/individual.

Any spat which reached the size of about 1 mm was put into a breeding basket which was made of Netron net. We put 1,000 individuals in each basket and suspended the baskets from a rope, which was installed in the sea in front of the center.

RESULTS

1. Conditions of Maturity and Spawning Inducement of Mother Shells

The conditions of maturity of mother shells are shown in Table 1.

It seems that maturity comes faster in Moura than in Kawauchi.

The results of spawning inducement, which was performed on April 3, are shown in Fig. 1. Out of 20 shells, 18 showed spawning and spermatization. The remaining 2 showed nothing even after 10 hours. As the mother shells were beyond the oviposition period, the amount of spawning was scarce and many of the eggs were lumpy. p.112

2. Early Development

The process of early development was that 2 cells developed 90 minutes after fertilization, cilia developed and rotation movement started 12 hours later, trochophorae started floating 16 hours thereafter and most of them became early D-type larvae about 60 hours after fertilization.

3. Conditions of Rearing Free-Swimming Larvae

The method and results of rearing in each tank are shown in Table 2. In the tank No. 2, which showed the best result, we gained approximately 300,000 attached spats.

The results in growth and survival rate of free-swimming larvae of scallop in the polyethylene tanks are shown in Fig. 2. The expansion of the umbo started 12 days after fertilization (average length 192 μ). p. 113

The eye spots started appearing on the 14th day (average length 262 μ) and 100% of the eye spots came out on the 18th day. Therefore, we put a collector in the tanks on that day. In the evening of the day, the movement of the larvae became slow, and some of the them started producing legs and began the attaching activity. The average length reached 290 μ on the 19th day, and we observed that more than half of the larvae were attached to the collector.

We reduced the frequency of changing water because of the deterioration of water quality (PH 8.8) due to the construction of a concrete breakwater near the intake of seawater.

From May 21 to June 5, we traced down the length of the attached spats at the time of attachment by observing the characteristic marginal shell which is formed after the attachment of larvae. As Fig. 3 shows, the average length was 287μ and it coincides roughly with our estimated length at the time of attachment.

4. Growth of Attached Spats

Fig. 4 shows the growth of attached young shells in the polyethelene tanks. The average growth of the free-swimming larvae was about 10μ/day, but the growth of the attached young shells was about 40μ/day. Also we observed a remarkable growth of the marginal shell after the attachment.

We guess that the slow growth in the tank No. 2 was due to the excessive density of attachment on the hemp-palm bark.

The reason why we lowered the temperature on the 27th day after the start of rearing was that some of the spats (about 0.9 - 1.0 mm) were about to be put into the open sea and we wanted to let them adjust to the temperature of natural seawater.

5. Conditions of Attachment of Spats according to the Type of Collectors.

Hi-zex film, which was used in the tank No. 1, gave us the impression that its attachment condition was slightly inferior to the hemp-palm bark. However, there were many shells attached to the creased parts of the film. This means that when we use the film, we had better crumple it well and make many creases. Otherwise, with regard to handling and observation convenience, the film was superior to the bark.

The hemp-palm bark in the tank No. 2 gained a good attachment rate, but there was a tendency for the shells to get attached in groups in some places.

In these places, the growth was slow, therefore, we had to separate the shells artificially. This caused us more troubles than in the other collectors. In case of Hi-zex film and polycarbonate film, we were able to observe the spats attached to the other side by seeing through the transparent film, but in case of the bark, it was really hard. This was another drawback in the hemp-palm bark. p.114

Regarding the polycarbonate film in the tank No. 3, the spats did not attach to the slippery surface in the beginning and were attached only around the cut ends, but later they moved to the flat part gradually. This problem could be solved by making many creases and cuts on the film.

DISCUSSION

1. Speed of Growth

The days needed this year for larvae to shift to the attaching period after fertilization was 18-19 days reared at 17°C.

Ito, et al. (1965) needed 28-36 days at 13-17°C, and Sato, et al. (1967) needed 15 days at 14-16°C. It is profitable in the work of breeding to shorten this period. One of the important factors in deciding the length of the period seems to be water temperature. It is necessary to examine further the suitable temperature for rearing free-swimming larvae.

2. Feed

After the attachment, there was a remarkable growth of the marginal shell. It seems necessary to develop suitable feed for this purpose.

3. Breeding of Attached Spats

There are many problems regarding water change, feed, and others

in breeding attached spats in a tank for a long period. In seed collection in this study, the number of shells which could be transferred to the open sea was about 170,000. It was less than half of the estimated number of the attached shells (about 470,000). Therefore, at this stage of research, it is better to suspend the shells into the sea as soon as possible. Among the attached spats, the shells whose length was 300μ were judged ready for transfer and even 500μ shells were observed to have fallen off when the collector was moved. We have to study further the range of the length of shell in which falling-off is observed and the death rate of shells after transfer to the sea.

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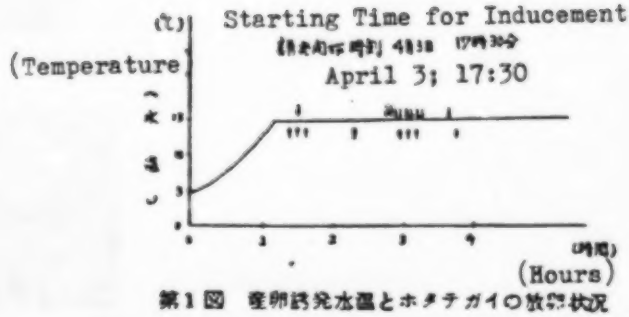
第1表 母貝の成熟状況 (Table 1. Maturity Conditions of Mother Shells)

Places for Collection	Dates of Collection	Dates of Inducement	Length 殻長 cm	Age 年令	Rate of Inducement ♀(%)	Rate of Inducement ♂(%)	Maturity 成熟度 ♀(%)	Maturity 成熟度 ♂(%)	Remarks 備考
Moura 茂浦	2/12		11.5～14.3	4	-	-	25.2	23.7	
Tsuchiya 土屋	3/16	-	7.3～11.2	2	-	-	18.5	18.8	
Moura 茂浦	3/30	-	12.2～14.5	3～5	-	-	21.0	24.1	
Kawauchi 川内	3/30	-	10.8～16.8	3～7	-	-	32.7	27.3	
Kawauchi 川内	3/30	4/1	10.7～14.2	3～5	0	0	18.0	19.1	3/30より筏へ垂下 Suspended from a raft on March 30.
Moura 茂浦	4/1	4/1	11.5～15.6	4	38.5	58.3	14.7	18.4	
Kawauchi 川内	3/30	4/2	10.3～15.8	3～7	10.0	50.0	26.5	24.5	3/30より抑制 Under control from March 30
Moura 茂浦	4/3	4/3	12.1～14.6	4	0	0	19.1	19.1	
Kawauchi 川内	4/3	4/3	12.1～15.2	4～6	66.7	100	22.3	23.8	幼生飼育 larvae

Table 2. Results of Rearing Free-Swimming Larvae of Scallop

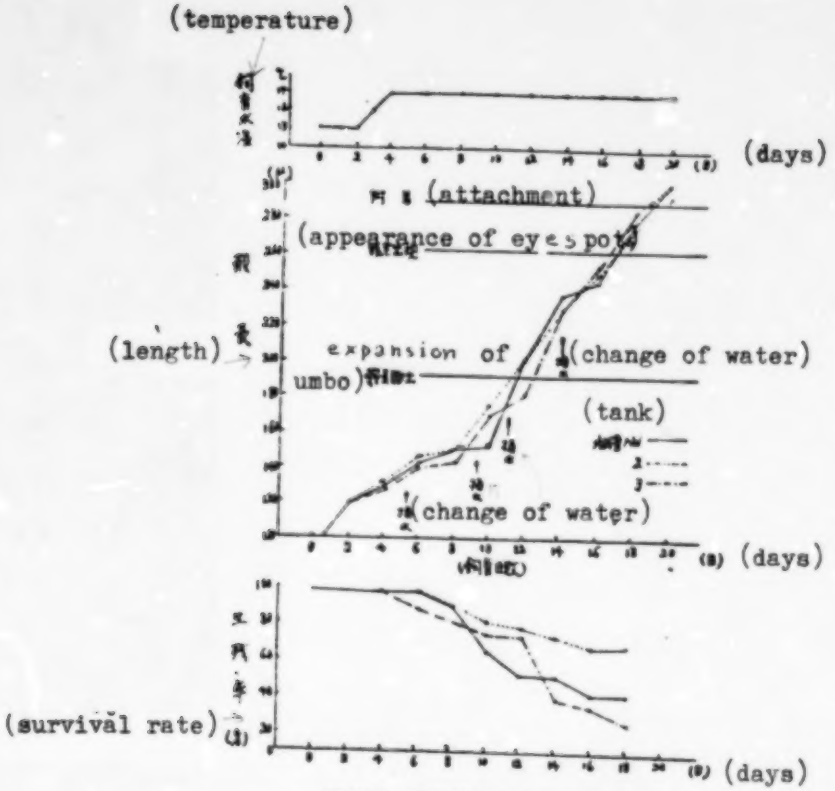
Fish Tank No.	Temperature	Number of Larvae per Tank	Density of Larvae	Capacity of Tank	Dates of Fertilization	Days Needed for expansion of Umbo
1	15-17°C	230,000	467/ℓ	500 ℓ	April 3	12
2	"	500,000	1,000/ℓ	"	"	"
3	"	270,000	540/ℓ	"	"	"

Survival Rate till Expansion of Umbo	Days Needed until Attaching Period Began	Survival Rate and Number of Surviving Individuals up to the Attaching Period
54 %	18	43 % Approx. 100,000
85 %	"	60 % " 300,000
74 %	"	28 % " 75,000



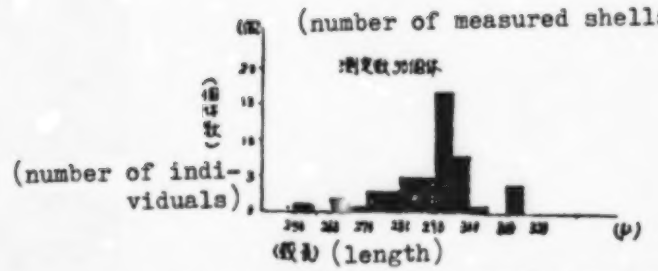
第1図 産卵誘発水温とホタテガイの放出状況

Fig. 1. Water Temperature for Spawning Inducement and the Condition of Spawning of Scallop



第2図　浮遊幼生の成長過程と生残率

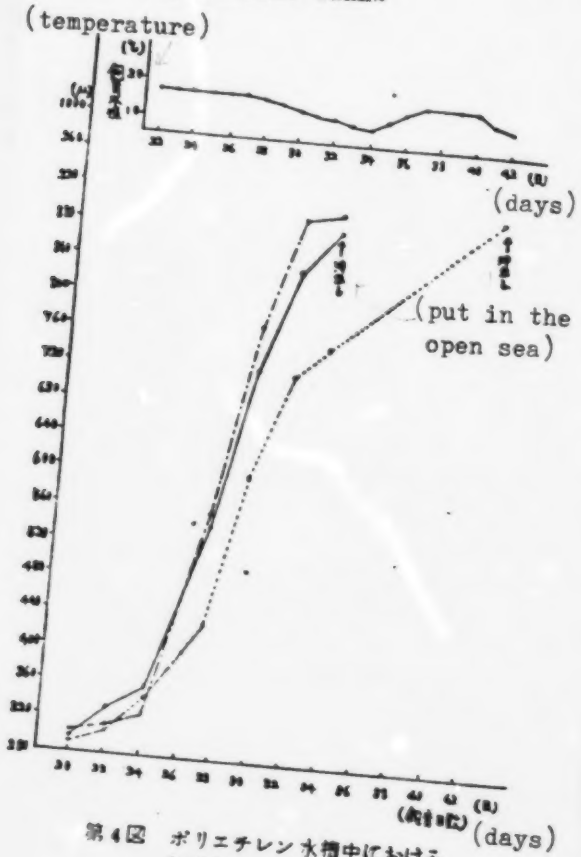
Fig. 2. Growth Process and Survival Rate of Free-Swimming Larvae.



第3図　殻縁殻の追跡による付着稚貝の付着時の殻長

Fig. 3. Length of Attached Spats at the Time of Attachment by Tracing the Marginal Shell

Fig. 4. Growth of Attached Spats in Polyethelene Tanks



第4図　ポリエチレン水槽中における付着稚貝の成長